Introduction

► I develop a general equilibrium model to study the economic impacts of the limits to arbitrage in the segmented markets.
► By incorporating the aggregate production and the asset mispricings in a unified framework, I provide an alternative mechanism to explain financial crises and the post-crisis recovery. I model the direct cause of crises via the breakdown of arbitrage transactions.
► I derive both the model dynamics and multiple equilibria in a closed form solution. I describe the crisis scenario as the case when the economy shifts from one equilibrium to the other.

Model

Figure 1: The structure of the economic system.

The infinite-horizon economy is populated with a continuum of competitive intermediaries (IM) and households (HH). There is only one perishable consumption good.

Households live within two separated markets
► experience equal but opposite (u) units of random endowment shock  𝜋𝑖, every period, i.e.,  𝑢−𝑢=𝑢>0.

Financial Assets are identical in each market
► long-lived assets, paying out dividend equal to the endowment shock  𝜋𝑖, each period
► in net-zero supply
► traded each period by IM and HH with positions  𝑥𝑖 and  𝑦𝑖, where  𝑖∈{A,B}
► perfect instrument to hedge against HH’s endowment shocks
► HH from different markets have opposite hedging demand → price gaps

Intermediaries are both arbitrages and entrepreneurs
► can trade financial assets in both markets and exploit the price differences
► can convert consumption one-to-one into capital and vice versa
► invest capital (depreciation rate  𝛿) and hire HH as labor with output function

Y𝑖 = 𝐹(𝐾𝑖−1) = 𝐾𝑖−1 𝐿𝑖 + (1 − 𝛿) 𝐾𝑖−1

Collateral Constraints
► IM have to post capital input as collateral to support their arbitrage trade
► collateral has to be enough to cover HH’s maximum loss if IM default or walk away from their positions in the next period
► IM’s total collateral upper limit at t: (1 − 𝛿) 𝐾𝑖

Multiple Equilibria – Two Steady States

For IM the future shock intensity
► collateral premium boosts capital:  𝐾𝑖 = 𝐹−1 −2 > 𝐹−1  𝛿
► steady state capital input is higher than the one in neo-classic growth model with frictionless markets

For HH two equilibria
► binding collateral constraints  𝑥𝑖 𝜙𝑖 = (1 − 𝛿) 𝐾𝑖
► bad regime: small volume  𝑥𝑖 & large price spread  𝜙𝑖
► good regime: large volume  𝑥𝑖 & small price spread  𝜙𝑖

Crisis

Crisis when shifting from good to bad after a tiny negative shock
► price spreads widen to fit the bad regime
► large initial trading positions inherited from the good one
► financial distress or insolvency

Cranes unavoidable even when switching to a good regime similar crises happen
► as long as the new regime features a bigger price spread

Conclusion

► Given financial frictions, such as market segmentation and collateral constraints, certain degree of mispricings arising from insufficient arbitrage can boost the production sectors with higher capital investment and output level.
► This is because arbitrages’ binding collateral constraints makes their capital investment have positive shadow value serving as collateral in the financial markets, which encourages producers to invest more and produce more.
► The mispricings with limited arbitrage activities can also increase the systemic risk and render the economy vulnerable to financial crises.
► Due to the regime shifts, the economy might experience a slow and partial recovery after the financial crisis.

Optimization Problems

Intermediaries’ optimization problem

\[
\max_{\gamma \theta} \int \sum_{t=0}^{\infty} \beta^t \log (\gamma^t \theta^t) 
\]

subject to budget constraint

\[
\gamma_{t+1}^B + K_i = -x_i (F(\theta_{t+1}) - P_t^B) + x_i (F(\theta_{t+1}) - P_t^A) + F(\theta_{t+1}) + (1 - \delta) K_{i-1}
\]

and collateral constraint

\[
-x_i (F(\theta_{t+1}) - P_t^B) + P_t^A + (1 - \delta) K_i \geq 0
\]

Households’ optimization problem

\[
\max_{\phi \theta} \int \sum_{t=0}^{\infty} \phi^t \log (\phi^t \theta^t) 
\]

subject to only budget constraint

\[
\phi_{t+1} = y_t^A (F(\theta_{t+1}) - P_t^A) - y_t^B (F(\theta_{t+1}) - P_t^B) + \phi_{t+1}^N \theta_{t+1} \phi_{t+1}^N 
\]

Labor Income from Trading assets

Income from Trading assets

Model Dynamics of IM’s Wealth, Investment and Consumption

Under binding collateral constraints, IM’s consumption and capital evolves according to

\[
C_t = (1 - \alpha \delta) W_t, \quad K_t = \alpha \delta W_t S_t
\]

where  𝑊𝑡 is IM’s wealth at the beginning of 𝑡,

\[
W_t := F(\theta_{t-1}) + (1 - \delta) K_{t-1} - x_i \phi_t - F(\theta_{t-1})
\]

and the leverage ratio:  𝑆_t = \frac{\phi_t + (1 - \delta) \phi_t}{\delta} > 1, where

► arbitrage gain serves as leverage to production
► negative interest loan to IM
► loan: immediate arbitrage gains; repayment: next period obligated settlement
► capital’s collateral premium, marginal return ↑, production output ↑

Recovery

Partial Recovery in Market Liquidity as the economy has switched to a different regime after the crisis, which features a lower trading volume

► help explain the slow and incomplete recovery of some asset markets after 2007-2009 crisis

Main References